Zerconid mites (Acari, Mesostigmata, and Zerconidae) from Turkey

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Received: 31.07.2008

Abstract: Two new species of zerconid mites, Zercon cokelezicus sp.n. and Z. mehmeturhani sp.n., collected from soil in Denizli, Turkey are described and illustrated on the basis of females. Additionally, a key to the adults of the genus Zercon known from Turkey is given.

Key words: Acari, taxonomy, Zerconidae, Zercon, new species, Turkey

Introduction
Mites of the family Zerconidae are an important member of soil fauna. Species of the genus Zercon are free-living and mostly associated with humus and soil, decomposed litter, leaf mould, plant parts, and mosses.

In all, 39 genera of the Zerconidae family are known in the Northern Hemisphere. Only 3 of these genera have been recorded in Turkey, namely Prozercon, Rafas, and Zercon. The genus Zercon, based on the number of species in Turkey and world-wide, is the richest in the family Zerconidae. The genus is estimated to include more than 300 species world-wide. Similarly, some papers were published on the family Zerconidae in the neighboring regions or countries, including the Balkan Peninsula (Willmann, 1941; Balogh, 1961; Kosir, 1974; Błaszak and Polanska, 1998; Kontschan, 2006; Ujvari, 2008a; 2008b), North Africa (Athias Henriot, 1961; Błaszak, 1979b), Russia (Petrova, 1977), Ukraine (Balan, 1992), and Caucasus (Balan and Vinnik, 1993).

To date, 44 species of the genus Zercon have been recorded from Turkey (Błaszak, 1979a; Urhan and Ayyıldız, 1993; 1996a; 1996b; Urhan, 1997; 1998a; 1998b; 2000; 2001a; 2001b; 2002; 2007; 2008a; 2008b; 2008c; 2008d; Urhan and Ekiz, 2002). Herein 2 new

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Zercon species—Z. cokelezicus and Z. mehmeturhani—are described based on material collected during studies on zerconid mites in Turkey.

**Materials and methods**

Soil and litter samples were collected on Çökelez Mountain (37°58’13˝N, 29°13´43˝E, at 1200 m asl) in Denizli Province (Turkey) on 2 May 2006 from a mixed forest (mostly *Pinus* sp.). The soil and litter samples were placed in plastic bags, labeled, and transferred to the laboratory. Samples were placed in combined Berlese funnels, and the mites were extracted for 5-7 days, according to their humidity. At the end of this process the contents of the bottles were transferred into petri dishes and the mites were separated under a stereo microscope. They were then placed in 60% lactic acid for clearing and mounted on permanent microscope slides using a glycerin medium. The mites were examined and illustrated using an Olympus BX50 microscope. Morphological terminology used in the descriptions follow that of Sellnick (1958), Halašková (1969), Błaszak (1974), and Mašán and Fenda (2004). All measurements are given as μm, presented as mean and range, or as approximations.

**Results**

**Family:** ZERCONIDAE  
**Genus:** Zercon C.L.Koch, 1836  
**Type-species:** Zercon triangularis C.L.Koch, 1836  
**Zercon cokelezicus** sp.n.

**Type material.** Holotype ♀. “Turkey, Denizli, Çökelez mountain, 37°58’13˝N, 29°13´43˝E, 1200 m asl, 02 May 2006, collected by R. Urhan”. Sample of litter and soil in a mixed forest (mostly *Pinus* sp.). Paratypes: 19 ♀♀, allotypes: 4 ♂♂, same data as holotype. Type deposition: Holotype (♀), paratypes and allotypes (19 ♀♀, 4 ♂♂) at the Department of Biology, Pamukkale University, Denizli, Turkey.

**Holotype**

**Female-Dorsal Idiosoma** (Figure 1A, B): Length of idiosoma in holotype 405 μm, width 285 μm, mean length and width of 19 paratypes 411 (398-430) and 291 (285-313) μm, respectively. Ornamentation of the dorsal shields is shown in Figure 1A. Dorsal pits are distinct and extended with a smooth anterior margin, medial pits with adjacent margins.

**Setae** (Figure 1A): Podonotal seta j1 is feathered and setae r1-r6 are finely barbed; the remaining setae of the podonotum are short and smooth. Opisthonotal setae J1, J2, Z1, Z2, and S1 are short and smooth. Setae J3-J6 are long and barbed, with hyaline tips. Seta J2 does not reach insertion of seta J3. Seta J1 reaches insertion of seta J4. Insertions of setae J5-J6 are 90 μm apart. Setae Z3 and Z4 are similar to seta J6. Seta J5 reaches insertion of seta Z4 and Z6 reaches the posterior margin of the opisthonotum. Seta Z5 is short and barbed, with hyaline tips. The distance between setae Z5-J6 is 25 μm. Seta S1 is similar to seta Z6 and does not reach the margin of the opisthonotum. Seta S2 is absent. Seta S3 is long and barbed, with hyaline tips. Setae R1-R7 are finely barbed. Lengths and mutual distances between opisthonotal setae are given in Table 1.

**Pores** (Figure 1A): Pore po1 lies inside the line connecting setae s1-s2. Pore po2 lies on the line connecting setae s3-j5. Pore po3 lies inside the line connecting setae s5-s6. Pore Po1 is located anteroaortiaxially to the insertion of seta Z1. Pore Po2 lies on the line connecting setae Z2-S2. Pore Po3 lies under the line connecting setae Z4-J4. Pore Po4 is located under the insertion of seta S4.

**Venter** (Figure 1B): The chaetotaxy and shape of the peritremal shield are typical for the genus. Adgenital shields present, with 4 setae on the anterior margin of the ventro-anal shield.

**Alotype**

**Male** (Figure 1C, D): Idiosoma in 4 specimens; mean length 339 (335-345) μm, mean width 236 (225-245) μm. Setae, pores, and sculpturing pattern on the podo- and opisthonotum as in female. The distance between setae J5-J6 and Z5-J6 average 84 μm and 23 μm, respectively. Lengths and mutual distances between opisthonotal setae are given in Table 1.

**Etymology:** The specific name, *cokelezicus*, reflects the name of Çökelez Mountain (Denizli, Turkey), from which the new species was collected.

**Remarks:** The new species, *Zercon cokelezicus* sp.n., is closely related to *Zercon burdurensis* Urhan, 2000 and *Zercon quadricavum* Urhan, 2001. The
Zercon mehmeturhani sp.n.

Type material: Holotype ♀. “Turkey, Denizli, Çökelez Mountain, 37°58´13˝N, 29°13´43˝E, 1200 m asl, 2 May 2006, collected by R. Urhan”. Sample of litter and soil in a mixed forest (mostly Pinus sp.). Paratypes: 28 ♀♀, allotypes: 6 ♂♂, same data as holotype. Type deposition: Holotype (♀), paratypes and allotypes (28 ♀♀, 6 ♂♂) at the Department of Biology, Pamukkale University, Denizli - Turkey.

Holotype

Female-Dorsal Idiosoma (Figures 2 A, B): Length of idiosoma in holotype 435 μm, width 295 μm, mean length and width of 28 paratypes 434 (423-448) and 294 (288-298) μm, respectively. Ornamentation of the dorsal shields is shown in Figure 2A. Dorsal cavities are distinct, equal in size, and well sclerotized, with axes parallel to the body axis.

Setae (Figure 2A): Podonotal seta j1 is feathered, j2 is pilose, and the remainder are short and smooth. Opisthonotal setae J1 and Z1 are short and smooth.
Zerconid mites (Acari, Mesostigmata, and Zerconidae) from Turkey

Table 1. Lengths and mutual distances between opisthonotal setae in *Zercon cokelezicus* (μm)

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<td>S₂</td>
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<td>Z₅</td>
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<td>J₆</td>
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Table 2. Distinguishing characters of the three related species of the genus *Zercon*

<table>
<thead>
<tr>
<th>Species Features</th>
<th>Z. burdurensis</th>
<th>Z. quadricavum</th>
<th>Z. cokelezicus sp.n.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seta S₁</td>
<td>Present and long, barbed, with hyaline tip.</td>
<td>Present and long, barbed, with hyaline tip.</td>
<td>Absent.</td>
</tr>
<tr>
<td>Seta J₁</td>
<td>Short and smooth.</td>
<td>Long and barbed, with hyaline tip.</td>
<td>Long and barbed, with hyaline tip.</td>
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<td>Marginal setae</td>
<td>Finely barbed.</td>
<td>Seta r₁-r₃ and R₁-R₇ smooth, r₄-r₆ and R₈, R₉ finely barbed.</td>
<td>Finely barbed.</td>
</tr>
<tr>
<td>Seta Z₅</td>
<td>Finely barbed.</td>
<td>Finely barbed.</td>
<td>Short and barbed with hyaline tip.</td>
</tr>
<tr>
<td>Seta S₃</td>
<td>Short and smooth.</td>
<td>Barbed with hyaline tip.</td>
<td>Barbed with hyaline tip.</td>
</tr>
<tr>
<td>Pore Po₃</td>
<td>Lies on the line connecting setae Z₇-J₅ closer to Z₄c.</td>
<td>Lies on the line connecting setae Z₇-J₅.</td>
<td>connecting setae Z₇-J₅.</td>
</tr>
</tbody>
</table>

Seta Z₅ is barbed, with a hyaline tip. The remaining setae of the opisthonotum are barbed and considerably broadened, almost from insertion, and are terminally flattened with a hyaline ending. Seta J₁ does not reach insertion of seta J₃ and seta J₄ reaches insertion of seta J₅. Seta J₆ does not reach the posterior margin of the opisthonotum. Insertions of setae J₆-J₆ are 105 μm apart. Seta Z₄ does not reach insertion of seta Z₅ and seta Z₅ reaches insertion of seta Z₆. Seta Z₆ reaches the posterior margin of the opisthonotum. The distance between setae Z₆-J₆ is 25 μm. Seta S₅ does not reach insertion of seta S₆ and seta S₇ reaches the margin of the opisthonotum. All marginal setae of the opisthonotum are short and smooth. Lengths and mutual distances between opisthonotal setae are given in Table 3.

**Pores** (Figure 2A): Pore po1 lies inside the line connecting setae s₁-s₂. Pore po2 lies on the line connecting setae s₄-j₄. Pore po3 lies on the line connecting setae s₅-z₂. Pore Po₁ is located anteroantiaxially to the insertion of seta Z₅. Pore Po₂ lies on the line connecting setae Z₇-S₁. Pore Po₃ lies on the line connecting setae Z₇-J₅. Pore Po₄ is located under the insertion of seta S₄.

**Venter** (Figure 2B): The chaetotaxy and shape of the peritremal shield are typical for the genus.
Adenital shields are present, with 3 pores and 4 setae on the anterior margin of the ventro-anal shield.

**Allotype**

**Male** (Figure 2C, D): Idiosoma in 6 specimens; mean length 350 (343-355) μm, mean width 232 (230-235) μm. Setae, pores, and sculpturing pattern on the podo- and opisthodonotum as in the female. The distance between setae J6-J6 and Z5-J6 average 85 μm and 20 μm, respectively. Lengths and mutual distances between opisthodonotal setae are given in Table 3.

**Etymology:** I dedicate the new species to my father and son who are both named Mehmet Urhan.

**Remarks:** The new species, *Zercon mehmeturhani* sp.n., is closely related to *Zercon primus* Kosir, 1974 and *Zercon serenus* Błaszak, 1979. The distinguishing characters of the 3 related species of the genus *Zercon* are given in Table 4.

Figure 2. A-D. *Zercon mehmeturhani* sp.n. Female: A. Dorsum of idiosoma. B. Venter of idiosoma. Male: C. Dorsum of idiosoma. D. Venter of idiosoma.
Zerconid mites (Acari, Mesostigmata, and Zerconidae) from Turkey

<table>
<thead>
<tr>
<th>Table 3. Lengths and mutual distances between opisthonotal setae in Zercon mehmeturhani (μm)</th>
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<td><strong>♀♀</strong></td>
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<td>J₆</td>
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<th>Table 4. Distinguishing characters of the three related species of the genus Zercon</th>
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<tr>
<td><strong>Species Features</strong></td>
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<tr>
<td>Marginal setae</td>
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<tr>
<td>Dorsal cavities</td>
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<tr>
<td>Setae J₁ and Z₁</td>
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<tr>
<td>Setae z₂, s₅, and s₆</td>
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<tr>
<td>Setae j₃-j₆, z₁, and s₁-s₄</td>
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<tr>
<td>Podonotal pore po₃</td>
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<td>Opisthonotal pore Po₁</td>
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**Key to the Adults of the Genus Zercon Species Known from Turkey**

1 (33) Anterior margin of the ventro-anal shield with 2 setae.

2 (25) The long setae of the opisthonotum with hyaline tips.

3 (10) Setae J₁-J₅ are smooth.
4 (5) Seta $S_2$ with hyaline tip .................... *solenites* Harlov, 1942

5 (4) Seta $S_1$ is smooth.

6 (7) Seta $Z_3$ with hyaline tip .................... *inonunensis* Urhan, 2007

7 (6) Seta $Z_3$ is smooth.

8 (9) Seta $S_3$ is smooth .................... *lepurus* Błaszak, 1979

9 (8) Seta $S_3$ with hyaline tip .................... *separatus* Urhan, 2001

10 (3) Setae $J_4$-$J_5$ delicately barbed or with hyaline tips.

11 (16) Setae $I_4$-$J_3$ delicately barbed.

12 (13) Seta $Z_3$ delicately barbed and seta $J_2$ reaches the base of seta $J_3$ .................... *longisetosus* Urhan, 2008

13 (12) Seta $Z_3$ with hyaline tips and seta $J_3$ does not reach the base of seta $I_3$

14 (15) Seta $S_2$ delicately barbed and without hyaline tip .................... *fragilis* Urhan, 2001

15 (14) Setae $S_3$ with hyaline tips .................... *memorialis* Urhan, 2001

16 (11) Setae $I_4$-$J_3$ with hyaline tips.

17 (20) Setae $I_3$ does not reach the margin of the opisthonotum.

18 (19) Setae $J_1$, $J_2$, $Z_1$, and $Z_2$ are smooth .................... *colligans* Berlese, 1920

19 (18) Setae $J_1$ and $Z_1$ delicately barbed, setae $J_1$ and $Z_1$ with hyaline tips .................... *osmanelinensis* Urhan, 2008

20 (17) Setae $S_3$ reaches the margin of the opistthonotum.

21 (22) Seta $J_3$ with hyaline tip .................... *plumatopilus* Athias-Henriot, 1961

22 (21) Seta $I_3$ is smooth.

23 (24) Pore Po$_3$ between setal rows $Z$-$J$ .................... *insperatus* Błaszak, 1979

24 (23) Pore Po$_3$ between setal rows $Z$-$S$ .................... *huseyini* Urhan, 2008

25 (2) Long setae of the opisthonotum without hyaline tips

26 (30) Pore Po$_3$ on the line connecting setae $Z_4$-$J_5$

27 (28) Seta $Z_4$ does not reach the posterior margin of the opisthonotum, setae $r_3$-$r_6$ and $R_1$-$R_4$ are short and smooth, length of idiosoma: ♀ 416 μm .................... *ignobilis* Błaszak, 1979

28 (29) Seta $Z_4$ reaches the posterior margin of the opisthonotum, setae $r_3$-$r_6$ and $R_1$-$R_4$ delicately barbed, length of idiosoma: ♀ 452-497 μm .................... *hungaricus* Sellnick, 1958

30 (26) Pore Po$_3$ anterior to the line connecting setae $Z_4$-$J_4$

31 (32) Seta $J_2$ is short and smooth .................... *adoxyphes* Błaszak, 1979

32 (31) Seta $J_2$ is long and barbed .................... *caucasicus* Błaszak, 1979

33 (1) Anterior margin of the ventro-anal shield with 4 setae.


35 (34) Between setal rows $J$-$J$ and $J$-$Z$ no extra setae.

36 (59) Setae $I_4$-$J_3$ are smooth.

37 (38) Setae $J_4$ is absent .................... *beleviensis* Urhan, 2002

38 (37) Seta $S_3$ is present.

39 (40) Seta $S_3$ is delicately barbed .................... *serratus* Urhan, 2001

40 (39) Seta $S_3$ is smooth or with hyaline tip.

41 (50) Seta $S_3$ is long, barbed with hyaline tip.

42 (43) Seta $Z_3$ is short and smooth .................... *ozkani* Urhan and Ayyıldız, 1993

43 (42) Seta $Z_3$ is long with hyaline tip.

44 (45) Seta $S_3$ is long with hyaline tip .................... *andrei* Sellnick, 1958

45 (44) Seta $S_3$ is short and smooth.

46 (47) Seta $S_3$ is long with hyaline tip .................... *pinicola* Halašková, 1969

47 (46) Seta $S_3$ is short and smooth.

48 (49) Dorsal cavities are saddle-like and have smooth anterior margins, seta $S_3$ reaches the margin of the opisthonotum, length of idiosoma: ♀ 450-510 μm .................... *carpathicus* Sellnick, 1958
49 (48) Dorsal cavities are star-like with undulated and weakly sclerotised anterior margins, seta $S_3$ does not reach the margin of the opisthonotum, length of idiosoma: ♀ 423-433 μm ........................................................................... anatolicus Urhan, 2008

50 (41) Seta $S_1$ is smooth.

51 (52) Long setae of the opisthonotum are thick and terminally broad .......... berlesei Sellnick, 1958

52 (51) Long setae of the opisthonotum are thin and smooth.

53 (54) Seta $S_1$ does not reach the margin of the opisthonotum ................................ perforatulus Berlese, 1904

54 (53) Seta $S_1$ exceeds the margin of the opisthonotum.

55 (56) Pore Po$_3$ is between setal rows Z-X and the dorsal cavities are equal in size ........................ montanus Willmann, 1943

56 (55) Pore Po$_3$ is between setal rows J-Z and the outer dorsal cavities 2-fold larger than the inner cavities.

57 (58) Seta $J_3$ does not reach the base of seta $J_5$ ........................................... cabylus Athias-Henriot, 1961

58 (57) Seta $J_1$ reaches the base of seta $J_4$ .................................................. bulgaricus Balogh, 1961

59 (36) Setae $J_4$-$J_5$ are delicately barbed or with hyaline tips.

60 (61) Pore Po$_3$ is between setal rows Z-S .................................................. notabilis Błaszak, 1979

61 (60) Pore Po$_3$ is between setal rows J-Z.

62 (69) Setae $J_4$-$J_5$ are delicately barbed.

63 (64) Seta $S_2$ is absent ................................ uludagicus Urhan, 2008

64 (63) Seta $S_3$ is present.

65 (66) Seta $S_2$ is smooth .................................................. foveolatus Halašková, 1969

66 (65) Seta $S_2$ is delicately barbed or with hyaline tip.

67 (68) Setae $S_2$ and $S_3$ are delicately barbed ........................................... kackaricus Urhan and Ekiz, 2002

68 (67) Setae $S_2$ and $S_3$ with hyaline tips .................................................. septemporus Urhan, 2001

69 (62) Setae $J_4$-$J_5$ with hyaline tips.

70 (73) Seta $J_1$ is short and smooth.

71 (72) Seta $S_2$ is short and smooth ............................................................... burdurensis Urhan, 2001

72 (71) Seta $S_2$ with hyaline tip ................................................................. kezbaniremae Urhan, 2007

73 (70) Seta $J_1$ is long with hyaline tip.

74 (77) Seta $S_1$ is smooth.

75 (76) Seta $S_3$ is present ................................................................. quadricavum Urhan, 2001

76 (75) Seta $S_3$ is absent .................. cokelcezicus sp. n.

77 (74) Seta $S_1$ delicately barbed or with hyaline tip.

78 (79) Seta $S_1$ delicately barbed ................................................................. turcicus Urhan and Ayyıldız, 1993

79 (78) Seta $S_1$ with hyaline tip.

80 (83) Setae $R_1$-$R_7$ are smooth.

81 (82) Seta $Z_5$ is smooth ................................................................. delictatus Urhan and Ekiz, 2002

82 (81) Seta $Z_5$ with hyaline tip ................................................................. mehmeturhani sp. n.

83 (80) Setae $R_1$-$R_7$ are delicately barbed or with hyaline tips.

84 (87) Setae $R_1$-$R_7$ are delicately barbed.

85 (86) Seta $J_1$ is delicately barbed ................................................................. aplitellus Błaszak, 1979

86 (85) Seta $J_1$ is short and smooth ................................................................. encarpatus Athias-Henriot, 1961

87 (84) Setae $R_1$-$R_7$ with hyaline tips.

88 (89) Setae $J_1$ and $Z_1$ with hyaline tips ................................................................. ayyıldızı Uhlan, 1997

89 (88) Setae $J_1$ and $Z_1$ are smooth.

90 (91) Setae $J_5$ and $Z_4$ do not reach the posterior margin of the opisthonotum .................................................agnostus Błaszak, 1979

91 (90) Setae $J_5$ and $Z_4$ reach the posterior margin of the opisthonotum .......... salmani Urhan, 2002.
References


